The U.S. Eastern Continental Shelf Carbon Cycling Project: U.S. ECoS

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USECoS PROJECT OVERVIEW

Although the oceans play a major role in the uptake of fossil fuel CO₂ from the atmosphere, there is much debate about the contribution from continental shelves, because many key shelf fluxes are not yet well quantified: the exchange of carbon across the land-ocean and shelf-slope interfaces, air-sea exchange of CO₂, burial, and biological processes including productivity. Because of the undersampling typically associated with most observational studies, model-derived carbon flux estimates are likely to be the only viable approach for defining these fluxes in a consistent manner on annual time scales. The goal of the USECoS (U.S. Eastern Continental Shelf Carbon Cycling) project is (1) to quantify these coastal carbon fluxes in this region using models quantitatively evaluated by comparisons with observations, and (2) to establish a framework for predicting how these fluxes may be modified as a result of climate and land use change.

OCEAN BIOGEOCHEMICAL CIRCULATION MODEL

Map of the U.S. East Coast showing the boundaries of the Mid-Atlantic and South Atlantic Bights (MAB & SAB) and the Gulf of Maine (GOM) used in the USECoS analyses.

IMPACTS OF CLIMATE AND LAND USE CHANGE

The sensitivity of biogeochemical cycling to changes in river discharge is examined through simulations that double and halve freshwater and nutrients individually and simultaneously. Results indicate that doubling river input increases air-sea CO₂ flux more than productivity (PP). Whereas increases in nutrient discharge increase both air-sea CO₂ flux and PP, increases in freshwater input enhances stratification which causes increases in air-sea CO₂ flux, but decreases in PP. (See Poster 20 by J. Xue.)

SATellite DATA ANALYSES

Our ocean biogeochemical circulation model is being evaluated with multiple remote-sensing products. In addition to standard products such as SST, chl and PP, we have also developed regional algorithms for species specific chlorophyll (see Poster 21 by K. Hyde), DOC and POC (see Poster 105 by A. Manninos) and pOC (see Poster 83 by S. Signorini).

SIMULATED CARBON FLUXES

The coupled ocean biogeochemical circulation model is now being used to compute carbon fluxes along the U.S. eastern continental shelf. Initial results indicate that presently this region acts as a sink of atmospheric CO₂ of roughly 6.5 TgC/ year (see Table below). Offshore transport of POC and DOC are each roughly 10 times greater than burial on the shelf.

DYNAMIC LAND ECOSYSTEM MODEL

Conceptual diagram of the Dynamic Land Ecosystem Model (DLEM). The DLEM will be used to generate riverine freshwater and nutrient input which will be used to force the coastal ocean model. For more information on the details of DLEM and preliminary results in the USECoS region, please see Poster 21 by H. Tian.

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